a. illuminating a pair of intersecting stripe shaped regions on the semiconductor wafer, and

b. detecting at least some of the light scattered from the area illuminated but not specularly reflected light as said semiconductor wafer is moving using a lens and CCD camera having a square array sensor and operational in a time delayed integration model.

REMARKS

The comments by the Examiner in the above noted Office Action have been diligently studied. Reconsideration of the application in light of this amendment is respectfully requested.

Claims 1-3, 11, 14, 16, 18 and 19 have been amended. No claims have been canceled or added. Therefore, claims 1-19 are under active consideration.

Under separate paper the Examiner has been asked to approve a drawing change which is submitted will overcome the objection to the drawings noted in paragraph 1 of the Office Action. Withdrawal of the objection is respectfully urged.

The abstract has been amended to overcome the objection noted in paragraph 2 in the Office Action. Withdrawal of the objection is respectfully urged.

Claims 1-3, 11, 14, 16, 18 and 19 have been amended to overcome the objections noted in paragraphs 4-6 of the Office Action. Withdrawal of the objection to these claims is respectfully urged.

Claim 19 stands rejected under 35 USC 103(a) as being unpatentable over Morshige et al. in view of Bishop. This rejection is respectfully traversed.

Applicant has invented a method and apparatus for inspecting a surface of a semiconductor wafer having repetitive patterns for contaminant particles using scattered light which involves directing two beams of light at different approach angles onto the surface in a manner so as to illuminate two intersecting stripe shaped regions on the surface. An imaging lens collects scattered light from the surface as the semiconductor wafer is moving and then images the scattered light collected onto a CCD camera having a square array sensor and arranged to operate in a time delayed integration (TDI) mode. The field of view of the CCD camera is centered at the intersection of the two striped regions. Each light beam striking the surface produces a Fourier diffraction pattern of scattered light in the back focal plane of the imaging lens. In setting up the apparatus, the angle of incidence of one of the light beams is adjusted to shift one of the diffraction patterns, if necessary, so that it overlaps the other diffraction pattern. If the two approach angles are symmetrically disposed, then the two diffraction patterns overlap and adjustment of the angle of incidence of one of the beams is not necessary.

The problem with Morshige combined with Bishop is that neither reference, amongst other things shows illuminating a pair of intersecting stripe shaped regions on the surface.

Accordingly, withdrawal of the rejection is respectfully urged.

Claims 1-10 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-10 of USSN: 09/518,977. To overcome this rejection, application is submitting herein a Terminal Disclaimer. Withdrawal of the rejection is respectfully urged.

The allowance of claims 11-13, 15, and 17 is noted with appreciation.

Allowance of the application with claims 1-19 is earnestly solicited.

Respectfully submitted,

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I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to Box Fee Amendment, Commissioner of Patents, Washington, D. C. 20231 on 10-30-02.

Irving M. Kriegsman

Marked-up Paragraph In Specification Page 19, lines 18-19

First beam of light 40-1 strikes surface 12 on semiconductor wafer 13 so as to illuminate a first striped shaped region 40-2, as can be seen in Fig. [5] 6.

Marked Up Abstract

A method and apparatus for inspecting a surface of a semiconductor wafer having repetitive patterns for contaminant particles using scattered light which involves directing two beams of light at different approach angles [which are independent from each other] onto the surface in a manner so as to illuminate two intersecting stripe shaped regions on the surface. [The two beams of light are positioned so that the two stripe shaped regions intersect on the surface.] An imaging lens [disposed above the surface] collects scattered light from the surface as the semiconductor wafer is moving and then images the scattered light collected onto a CCD camera having a square array sensor and arranged to operate in a time delayed integration (TDI) mode. The field of view of the CCD camera is centered at the intersection of the two striped regions. Each light beam striking the surface [of the semiconductor wafer] produces a Fourier diffraction pattern of scattered light [scattered from the surface] in the back focal plane of the imaging lens. [In the two diffraction patterns are offset from each other if the two approach angles are not symmetrically disposed relative to an axis of the wafer.] In setting up the apparatus, the angle of incidence of one of the light beams is adjusted to shift one of the diffraction patterns, if necessary, so that it overlaps the other diffraction pattern. [In this way, a spatial filter having masking bars sized and shaped to mask off the diffraction pattern from one beam will also mask off the diffraction pattern from the other beam.] If the two approach angles are symmetrically disposed, then the two diffraction patterns overlap and adjustment of the angle of incidence of one of the beams is not necessary. [The apparatus also includes an arrangement for independently setting each one of the two approach angles and independently

adjusting the angle of incidence of each light beam].

Marked Up Claims 1-3, 11, 14, 16, 18 and 19

1. (Amended) An apparatus for detecting the presence of contaminant particles on a surface of a semiconductor wafer having repetitive patterns, said apparatus comprising:

a. means for producing a first beam of light and a second beam of light,

b. first optical means for illuminating a first region area on the semiconductor wafer with said first beam of light,

c. second optical means for illuminating a second region on the semiconductor wafer sample with said second beam of light,

d. said first beam of light striking the semiconductor wafer at a first approach angle which is angularly adjustable and a first angle of incidence which is angularly adjustable,

e. said second beam of light striking the semiconductor wafer at a second approach angle which is angularly adjustable and a second angle of incidence which is angularly adjustable,

f. said first approach angle and said first angle of incidence being adjustable independent of said second approach angle and said second angle of incidence, respectively,

g. an imaging detector disposed above the semiconductor wafer for detecting light scattered from the area illuminated but not specularly reflected light,

h. an imaging lens for imaging said area illuminated on said imaging detector, said imaging lens having a Fourier plane, and

i. a spatial filter in the Fourier plane of the imaging lens for masking off the

diffraction pattern produced by the background on the semiconductor wafer from each one of the two illuminating beams of light.

2. (Amended) An apparatus for detecting the presence of contaminant particles on a semiconductor wafer having repetitive patterns, said apparatus comprising:

a. means for producing a first beam of light and a second beam of light,

b. first optical means for illuminating a first region on the semiconductor wafer with said first beam of light,

c. second optical means for illuminating a second region on the semiconductor wafer with said second beam of light,

d. said first beam of light striking the semiconductor wafer at a first approach angle and a first angle of incidence,

e. said second beam of light striking the semiconductor wafer at a second approach angle and a second angle of incidence,

f. said first optical means including a variable angle mirror for varying the first angle of incidence,

g. said second optical means including a variable angle mirror for varying the second angle of incidence,

h. a first tower for holding said first optical means, said first tower being angularly movable so as to change said first approach angle,

i. a second tower for holding said second optical means, said second tower being angularly movable so as to change said second approach angle,

j. said first approach angle and said first angle of incidence being adjustable independent of said of said second approach angle and said second angle of

incidence, respectively,

k. an imaging detector disposed above the semiconductor wafer for detecting light scattered from the area illuminated but not specularly reflected light,

l. an imaging lens for imaging said area illuminated on said imaging detector, said imaging lens having a Fourier plane, and

m. a spatial filter in the Fourier plane of the imaging lens for masking off the diffraction pattern produced by the background on the semiconductor wafer from [bother] both illuminating beams of light.

3. (Amended) A method for detecting the presence of contaminant particles on a semiconductor wafer having repetitive patterns, said apparatus comprising:

a. illuminating a portion of the semiconductor wafer with first and second beams of light,

b. said first beam of light striking the semiconductor wafer at a first approach angle which is angularly adjustable and a first angle of incidence which is angularly adjustable,

c. said second beam of light striking the semiconductor wafer at a second approach angle which is angularly adjustable and a second angle of incidence which is angularly adjustable,

d. said first approach angle and said first angle of incidence being adjustable independent of said second approach angle and said second angle of incidence, respectively,

e. adjusting said first and second approach angles to minimize background scatter,

f. positioning an imaging detector above the semiconductor wafer for detecting at least some of the light scattered from the area illuminated but not specularly reflected light,

g. providing an imaging lens for imaging said area illuminated on said imaging detector, said imaging lens having a Fourier plane,

h. providing a spatial filter in the Fourier plane of the imaging lens for masking off the diffraction pattern produced by the background on the semiconductor wafer from a first one of the two beams of light, and

i. adjusting said angle of incidence of the other beam of light so that the diffraction pattern formed by the other beam of light in the Fourier plane overlaps the diffraction pattern formed by the first beam of light.

11. (Amended) An apparatus for detecting the presence of contaminant particles on a surface of a semiconductor wafer having repetitive patterns, said apparatus comprising:

a. a holder for holding said semiconductor wafer,

b. a light source adapted to produce a first bream of light and a second beam of light, said first beam of light being disposed relative to the semiconductor wafer to illuminate a first stripe shaped region on the semiconductor wafer at a first approach angle, said second beam of light being disposed to illuminate a second stripe shaped region on the semiconductor wafer at a second approach angle, said second stripe shaped region intersecting said first stripe shaped region,

c. a CCD camera, said CCD camera being operational in a time delayed integration (TDI) mode, said CCD camera having a sensor,

d. an imaging lens disposed above the two stripe shaped regions for imaging onto said CCD camera at least a portion at an area on the surface containing at least a portion of the two stripe shaped regions using scattered light as the semiconductor wafer is moving, the imaging lens having a Fourier plane,

e. a filter disposed in the Fourier plane of said imaging lens for masking off the diffraction pattern produced by the background of the semiconductor wafer [form] from both beams of light, and

f. means for moving said holder continuously.

14. (Amended) The apparatus of claim 11 wherein said sensor in the CCD camera is a square array sensor.

16. (Amended) The method of claim [14] 15 and wherein said first and second regions intersect with the field of view of the CCD camera.

18. (Amended) An apparatus for detecting the presence of contaminant particles on a semiconductor wafer having repetitive patterns, said apparatus comprising:

a. a holder for holding said semiconductor wafer, movable along two mutually perpendicular axes,

b. a pair of linear motors for moving said holder translationally along two mutually perpendicular axes,

c. a light source for illuminating a stripe shaped region on the semiconductor wafer,

d. a CCD camera having a square array sensor and constructed to operate in a time delayed integration (TDI) mode disposed to detect light scattered from the [strip] stripe illuminated but not light specularly reflected from the area illuminated,

e. an imaging lens for imaging continuously the area illuminated by the stripe shaped region on said imaging detector s said holder is moved, said imaging lens having a Fourier plane, and

f. a filter disposed in the Fourier plane of said imaging lens for masking off the diffraction pattern produced by the background of the semiconductor wafer [form] from the beam of light.

19. (Amended) A method for detecting the presence of contaminant particles on a semiconductor wafer having repetitive patterns, said [apparatus] method comprising:

a. illuminating a pair of intersecting stripe shaped [region] regions on the semiconductor wafer [with a beam of light], and

b. detecting at least some of the light scattered from the area illuminated but not specularly reflected light as said semiconductor wafer is moving using a lens and CCD camera having a square array sensor and operational in a time delayed integration model.